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ABSTRACT

Wisconsin is the country's leading manufacturer of small engines, and the network of companies and suppliers constituting the small engine industry accounts for more than 5% of the state's entire manufacturing base. For the past 15 years, the industry has been rocked by intensified international competition and rapid technological advancement. A comparative case study of work reorganization in Wisconsin's small engine industry was conducted. The study focused on the following: the effects of changing labor-management relationships and technological advances on the market focus and work organization of small engine manufacturing; low-wage versus high-skill business strategies; and diffusion of high-performance practices. In view of the study findings, it was recommended that the Wisconsin Technical College System take the following actions: (1) support curriculum development projects associated with the development of skills standards benchmarked to advanced industry practices; and (2) use extension services to extend the coverage of skills standards and wage norms from industry leaders to the rest of the sector. A three-tiered system of manufacturing certificates to document mastery of traditional basic, applied occupational, and advanced occupational skills was proposed along with a six-level model for a mature occupational training system in durable goods manufacturing was proposed. (MN)

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Small Engine Manufacturing in Wisconsin:

Work Reorganization and Training Needs

Report to the Wisconsin Technical College System

by the Center on Wisconsin Strategy

June 1994

This report was prepared under the supervision of Joel Rogers and Wolfgang Streeck. Research assistance was provided by Noel Harvey, Stephanie Luce, Eric Parker, Dan Smith, and Barbara Wootton.

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1. Introduction

Wisconsin is the leading manufacturer of small engines in the country. These engines are produced primarily for lawn mowers, snow blowers, recreational boats, motorcycles, and stationary power generation for industrial or other uses. The small engine industry directly employs 17,500 state residents, and exerts a large multiplier effect on indirect and induced employment in other industries.[1] The industry accounts for an estimated 32,000 additional jobs either in supplier firms or in firms that sell consumer goods and services to employees (MCLR, 1993). The network of companies and suppliers involved in small engine manufacturing accounts for more than five percent of state's entire manufacturing base. Employment is concentrated in engineering and skilled and semi-skilled production occupations. Industrial workers in the sector earn among the highest wages in the state. Average hourly earning are 24% higher than the state's manufacturing sector as a whole (1990). Therefore, Wisconsin has a tremendous stake in improving the economic performance of the sector to preserve large numbers of family-supporting jobs.

The small engine industry has been rocked by intensified international

[1] The closest proxy for small engines in the Standard Industrial Classification (SIC) system is 3519, internal combustion engines (not classified elsewhere) in the non-electrical machinery group. Although this is the closest approximation of the state's small engine industry, it incorporates large natural gas units, cogenerator sets and the like, and excludes engines manufactured by OEMs that are categorized by their own final products, such as motorcycles, automobiles, agricultural implements and the like.

competition and rapid technological change for the last 15 years. The local production of standard engines has been undermined both by price competition from low-wage regions, especially in southern states, and by lower price premia for specialized engines from other high-wage regions, especially in Japan. Whereas product performance rules cost-plus defense contracts, and price competitiveness rules the market for standard products, world markets increasingly behave as though small engines are capital goods valued according to their price-to-performance ratios. The most rewarding segments of the world small engine market demand quality, variety, timeliness, service and delivery at a favorable price. This premium range of the market requires more or less continuous adaptation and innovation.

High performance organizations depend upon a highly qualified supplier base and a highly skill workforce. Wisconsin cannot preserve its high-wage job base in small engine manufacturing without a substantial commitment to supplier modernization and workforce development. But it does not necessarily follow that these leading companies will actually adopt high performance practices that would require and warrant state support. Market signals and new technology are insufficient conditions for industrial upgrading to occur among the lead firms and their supplier networks.

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First, market forces do not mandate high performance practices. Management may position their companies in increasingly segmented world markets either by squeezing suppliers and employees for short-term cost advantages, or by cooperating with these stakeholders for incremental improvement over a longer time horizon. Although management would prefer to have their cake and eat it too, they generally recognize the incompatibility of the price-competitive and quality-competitive alternatives. Management is unlikely to invest in the supplier base and workforce in the area without an expectation of staying in the state, and qualified suppliers and skilled workers are unlikely to embrace organizational goals without confidence in the fair distribution of mutual gains.

Second, the information processing, storage and retrieval capabilities of microelectronic technology permit tremendous variation in workplace practices. At one extreme, management may consolidate centralized control over the entire production process to enhance the repeatability of small batches of standard parts and finished products. At the other extreme, management may decentralize responsibility throughout an organization to enhance the flexibility of changeovers between small batches of diversified parts and products. All sorts of variation is possible in the extent to which employees participate in product

design, technology choice, plant layout, parts programming, and quality improvement. As a result, new technology reduces the importance of manual skills, but the demand for cognitive and interactive skills ultimately depends upon the business strategy chosen by management.

In a segmented world market environment, small engine manufacturers exercise some degree of strategic choice over market focus, technology utilization and work organization. But whatever the business strategy, these choices must be more or less consistent with one another. Management must either defend their company's traditional market focus on standard engines to avoid major investments in upgrading their inherited design and manufacturing capabilities, or reorganize the entire production process to pursue a substantially revised market focus. The menu of business strategies is presented in Table 1. Although product volume and product variety are continuous variables, the treatment of them as discrete variables highlights the conditions under which firms are likely to adopt high performance workplace practices and demand a highly skilled and committed workforce.

Table 1
Typology of Firms

Firm Size	Product Profile	
	Standard Products	Custom Products
Small	[1] Sweatshop	[2] Craft Shop
Large	[3] Mass Production Organization	[4] High Performance Organization

The extreme cases among small and medium suppliers are the sweatshops in the first cell and the craft shops in the second. The sweatshops focus on a narrow range of standard products in small volumes. These shops compete for contracts on the basis of lower wages and have few incentives or resources to develop workforce skills. By contrast, the craft shops design and manufacture specialized tools, dies, molds or other customized goods. Highly skilled employees work in project teams to plan and execute jobs from start to finish. The advanced shops are increasingly cooperating with one another to raise the level and quality of apprenticeship training throughout the local membership of their industry association.

Although many suppliers do not fit neatly into either category, they typically lack the design and manufacturing capabilities to perform high value-added work. Unlike large firms, they lack the internal resources to attract, train and retain a skilled workforce. Unlike craft shops, they lack the associational ties to pool their resources for collective training efforts. As a result, their primary source of competitive advantage is often lower wages. Many suppliers are unlikely to adopt high performance practices without upward pressure on wage norms, supplier certification requirements, or other standard-setting mechanisms. In fact, previous research indicates many of them may actually be

withdrawing from customary niches in their respective industries as international competitors or large domestic rivals utilize new technology to reduce the price premia for specialized goods (Parker, 1994; Rogers and Streeck, 1991).

The extreme cases among large firms are the lean production organizations in the third cell and the high performance organizations in the fourth. The lean producers focus on low-cost production for the price-sensitive range of their respective markets. These manufacturers adopt new technology and methods primarily to increase work intensity, to improve quality control, and to reduce inventory, handling, scrap and rework. They exert greater pressure on suppliers to reduce prices, control quality, and improve delivery. The high performance organizations focus on high quality production for the premium range of their respective markets. These manufacturers adopt new technologies and methods primarily to reduce product development time, improve product quality, and increase product variety. This requires closer integration of design and manufacturing, and greater decentralization of responsibilities and competencies within and across functional and organizational boundaries.

All the small engine manufacturers eventually reconfigured their operations over the last decade. They have all to various degrees invested in new technologies and converted to just-in-time logistics, total quality

management, and cellular manufacturing systems. But the social impact of work reorganization depends on the way in which new technologies and methods are implemented. The analytical question is the extent to which the public sector in general, and the technical college system in particular, have an opportunity to shape the strategic choices of these manufacturers for the better.

This report is based on a comparative case study of work reorganization in the state's small engine industry. This methodological choice was based on two considerations. The first was that the small population of firms in the sector precluded any meaningful quantitative analysis. The second was that the methodology needed to identify the tipping points at which specific firms adopt one strategy over another, rather than estimate the average effect of nominally independent variables on some underlying universe of firms. These methodological considerations recommended a comparative case study that incorporated the principle manufacturers in the industry.

A comparative case study design holds certain causal factors constant and allows others to vary on a systematic basis. The objective is to identify invariant relationships between different causal configurations and specific outcomes. Strong conclusions are drawn when configuration x always results in outcome y, and outcome y never results from any other configuration. Although this

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establishes an extremely high burden of proof, anomalous cases are welcomed as an opportunity for further speculation, new questions, and additional research.

All six firms in this study produce similar products with similar technology. They are all confronted by the same set of competitors in world markets. They are all relatively large firms with a tradition of Taylorist work organization and job control unionism. They are all drawing from the same population of supplier firms in the region, and operating in the same institutional and policy context. And they all have the option of leaving the state. The puzzle is that cases so similar to one another can yield totally different outcomes.[2]

Comparative studies require a comprehensive understanding of each case. This report is based on an analysis of trends in the market, new technology, work reorganization, supplier relationships, labor relations, and human resource practices. Data collection entailed background interviews with managers and union officers, plant tours, primary documents such as stockholder reports, and secondary literature in the business press. Any material from confidential interviews is presented in such a way as to conceal the identities of the

[2] For the sake of comparing the most similar cases in the state, the study excludes other engine manufacturers whose product profiles and competitive field are arguably different from the small engine industry. For example, Chrysler manufactures automobile engines, J.I. Case manufactures tractor engines, and Waukesha Engine manufactures natural gas engines packing 800 to 4800 horse power.

respondents.

The report begins with an overview of the variation in market focus, work reorganization, and, consequently, the emerging skills needs of firms in the industry. Two firms have adopted a price-competitive, low-wage business strategy, and one firm has adopted a quality-competitive, high-skill business strategy. The other three firms have been moving in the direction of the latter rather than the former, but recent moves by their competitors cloud the future. The next section compares an exemplary case of a lean production organization to the exemplary case of a high performance organization. These cases are contrasted with respect to their market focus on the one hand, and their labor relations, supplier relations, and training practices on the other. Finally, the case is made for building labor market institutions that can coordinate public and private efforts to improve labor relations, occupational training, and supplier modernization. The report concludes with a set of policy recommendations for the technical college system to fulfill its mission of improving the economic performance of this important industry, and preserving family-supporting jobs in the state.

2. Work Reorganization in the Small Engine Industry

Prior to the economic crisis of the early 1980s, the state's small engine

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manufacturers specialized in designing and manufacturing engines for one type of final product or use. Each company strived to achieve economies of scale in producing standard products over long life cycles. The cost advantage of mass production extended the market for standard engines in each of their respective markets. This standardization and differentiation resulted in an industry composed of three primary branches dedicated to outdoor power equipment (primarily lawn mowers and garden tractors), outboard marine engines, and motorcycle engines. Each branch was, in turn, composed of a small number of oligopolistic firms located in relatively close geographic proximity to one another in the upper Midwest and especially in Southeastern Wisconsin and Northeastern Illinois (see Table 2).

Table 2

	Briggs & Stratton	Kohler	Tecumseh	Outboard Marine	Mercury Marine	Harley-Davidson
Ownership	Publicly Traded	Privately Held	Publicly Traded	Publicly Traded	Publicly Traded	Publicly-Traded
Headquarters	Wisconsin	Wisconsin	Michigan	Illinois	Wisconsin	Wisconsin
Wisconsin Plants	5	2	3	3	3	3
End Product	lawn mowers, garden tractors & generators	generators	lawn mowers & snow blowers	recreational boats	recreational boats	motorcycles
Product Range	2-18 hp	4-24 hp	2-18 hp	2-300 hp	2-275 hp	883 cc, 1200 cc & 1340 cc
Distribution	OEMs	OEMs	OEMs	authorized dealers	authorized dealers	authorized dealers
Employment	6,500	6,500	1,700	1,000	2,300	1,000
Union	Industrial Workers	Autoworkers	Machinists	Steelworkers	Machinists	Industrial Workers
Relocation	Yes	Yes/No	No	Yes	No	Yes

Like other large oligopolistic companies during the heyday of mass production, the state's small engine manufacturers were organized like command and control hierarchies. Management established clear lines of authority over the workforce, and conducted arms-length transactions with similarly organized suppliers. New products were engineered and manufactured in a sequential process. The design department developed the specifications, and then turned them over to the manufacturing and purchasing departments. The manufacturing department would figure out how to build certain parts and assemble the product, and the purchasing department would let contracts for other parts and materials out for bid. Production workers and suppliers were only brought into the process at the very end when they would be rewarded for performing carefully prescribed tasks.

Each of the firms adopted a Taylorist form of work organization. The production process was subdivided into routine operations. Different types of machines were grouped together in their own area of the plant. Parts and materials flowed from one area to the next until they reached the assembly line. Routine operating tasks were sheltered from disruptions arising from material and part defects, delivery breakdowns, machine malfunctions and other problems or errors by large inventory buffers. Specialists were assigned to problem-

solving and coordination tasks to restore the production process to its routine operation whenever contingencies arose.

The industrial relations system conformed to the organizational requirements of Taylorism. Industrial unions accommodated managerial prerogatives in strategic business decisions, and confined their bargaining agenda to the mandatory issues of wages, hours and working conditions. They negotiated seniority rights, protective pay practices, and work load restrictions based on an elaborate system of narrowly defined job classifications. Administrative procedures and work rules defined jobs in terms of prescribed tasks. Production standards for these tasks established customary norms of work intensity. Workers accumulated base pay raises as they moved through a sequence of closely related jobs. Although promotions were nominally based on a combination of qualification and seniority, experience in one job could typically serve as a proxy for the qualification to bid on the next. Unions were attentive to technological and organization change only in terms of its impact on prevailing job classifications and their attendant work rules, production norms, base rates, and job assignments.

The hierarchical and adversarial relationship between management and labor resulted in a highly polarized skills profile between white collar managers

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and professionals on the one hand, and the frontline production workforce on the other. This common skills profile was matched by the development of a highly stratified occupational training system. College educated men were recruited for managerial and professional careers organized around discrete corporate functions. High school educated men entered the ranks of semi-skilled production workers. A small number of qualified incumbent workers received apprenticeship training for the skilled trades. The two-year technical colleges increasingly specialized in intermediate technician occupations that minimized engineering overhead costs and the technical content of production jobs.

Taylorist work organization, job control unionism, and narrow occupational training were predicated on a manufacturing environment that has been radically altered by two changes. The first major change was intensified international competition, primarily from Japanese companies that manufacture small engines for all branches of the industry. Whereas U.S. manufacturers typically concentrate on engines for specific final products or uses, Japanese manufacturers typically built upon their success in one market to move into others. After Honda, Kawasaki, Suzuki, and Yamaha established a strong presence in the motorcycle market, they subsequently entered the market for

lawn and garden equipment, recreational boats, or both.[3]

The second major change is new technology associated with the microelectronics revolution. Computer-aided design and manufacturing systems can generate digital descriptions of product designs, convert their specifications into machine instructions, and download the programs to machines on the workfloor. After testing and debugging programs, placing sensors and monitoring quality, and re-editing them, they are stored in parts libraries for repeated use. The construction of parts libraries around related products facilitates the storage and retrieval of variations and improvements. The repeatability and flexibility of programmable automation permit faster changeovers between batches of different parts. The program for each new part is downloaded as needed and then stored for later use when it can be retrieved again.

Japanese manufacturers effectively utilized what are now called lean production methods to realize the potential advantages of new technologies. These companies were more capable of bringing new products to market, making incremental improvements, offering greater variety, and reducing the

[3] In fact, some Japanese companies manufacture an even broader scope of engines. In addition to small engines, Honda, Mitsubishi and Suzuki, of course, manufacture automobile engines, while Kubota manufactures engines for agricultural and construction machinery.

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premia for quality products. This extended the market for specialized engines at the expense of the mass market. As one manager put it, "we weren't able to deliver everything that everyone wanted. What people actually wanted was much more than what they said they wanted." Greater market segmentation, in turn, eroded the scale economies of mass production.

In combination, greater competition and new technology are exerting tremendous pressure on the state's small engine manufacturers to transform their organizations. Shorter product life cycles raise product development costs and reduce the payback period. Frequent changeovers between diversified products increase the downtime of expensive capital equipment. Smaller batches increase inventory and handling costs in the absence of material flow adjustments. The absence of inventory buffers magnifies the disruptiveness of defects and malfunctions.

In response, all the companies have converted to cellular manufacturing systems, just-in-time logistics, and total quality management to trim costs and improve quality. Rather than group each type of machine in different departments and route parts and materials throughout the plant, dissimilar machines are grouped together in one area to produce distinct families of parts that are related to one another by common geometrical characteristics, material

attributes, and manufacturing requirements. When fully implemented, the simplified flow of material through the production process minimizes set-up and cycle time, reduces inventory and handling costs, cuts scrap and rework costs, and improves product quality and customer satisfaction. Small groups of workers who are responsible for the entire production process are in a better position to identify and solve problems as they arise.

The impact of cellular manufacturing on job design and skill content depends on the extent to which the traditional form of work organization is actually transformed. In some cases, cellular manufacturing leads to a greater variety of tasks without any substantial increase in discretion, autonomy or authority. Production workers become responsible for operating more than one type of machine at a time, coordinating production schedules and deliveries, measuring quality against specified tolerances, and performing routine preventive maintenance. But they are excluded from the more technical, problem-solving and decision-making aspects of the production process. In these cases, production workers often experience cellular manufacturing as an intensification of work.

However, in other cases, cellular manufacturing leads to both job enlargement and job enrichment. Production workers participate in cell layout

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and technology choice. They are responsible for performing parts programming and data editing, and completing projects on their own. They participate in continuous process improvement teams, and increasingly contribute incremental improvements in component parts and final products.

The market focus and work organization of small engine manufacturers are closely associated with one another. Although programmable automation eliminates manual control over the speeds, feeds, tool paths and tool sequences of machining operations, parts programs must always be tested, debugged, and edited as contingencies arise. The variation in the performance of machines, set-up of tools and workpieces, machinability of materials and rate of tool wear may be minimized, but never completely eliminated. Although centralized control economizes on the number of employees who must have programming skills, it imposes certain costs of coordination between programmers and the machine operators. These coordination costs become increasingly high as companies bring new products to market, diversify their product profiles, and reduce their batch sizes. As a result, firms that revise their traditional market focus the most are also undertaking the greatest transformation of their organizations.

Although their point of departure was more or less the same, the state's

small engine manufacturers are clearly moving along two divergent paths. At one extreme, Briggs & Stratton and Outboard Marine Corporation (OMC) are the cases most firmly positioned on the price-sensitive end of their respective markets. Briggs and OMC are the largest producers of lawn mower engines and outboard marine engines in the world. In each case, management's strategic objective is to remain the lowest cost producer in their markets. Although both companies have retained their machining operations in the Milwaukee area, they have transferred much or all of their assembly operations to new southern facilities. But as simple machining operations are sourced to southern plants, perhaps with the assistance of customized labor training grants, the local facilities become increasingly vulnerable to closure.

The motorcycle market is at the other extreme. After Japanese companies captured a huge portion of the market, Harley-Davidson became a high profile example of a U.S. company that managed to turn things around. Harley successfully reestablished itself as the premier manufacturer on the premium end of the market. And management's strategic objective is to stay there. The company continues to upgrade the design and manufacturing capabilities of its local operations, and is currently preparing to integrate production cells and engine assembly next year.

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The other three firms are intermediate cases. In the outdoor power equipment market, Tecumseh is the second largest producer of small lawn mower engines and the leading producer of snow blower engines. The company initially opened a southern assembly plant to remain price-competitive with Briggs, but has recently diversified into larger engines. As a result of unresolved coordination problems between machining and assembly operations, Tecumseh is upgrading local operations and bringing back some of the work performed at the southern plant. Meanwhile, Kohler has successfully defended its niche on the premium end of the market as a leading producer of stationary units for industrial users.

In the outboard marine engine market, Mercury Marine is OMC's leading competitor. Rather than compete on the basis of lower wages at non-union assembly plants, Mercury Marine continues to focus on improving the productivity and quality of its local operations. Although market contraction compelled management to close the local Force Outboard plant, which produced standard engines for the lower end of the market, Mercury Marine remains highly competitive on the quality end.

At the present time, Briggs and OMC are the only two firms "at-risk" of leaving the state all together. Tecumseh, Kohler and Mercury Marine are all

moving towards the quality-competitive strategy of Harley-Davidson. In fact, it appears that Tecumseh has actually backed away from a low-wage southern strategy. Whether these firms could withstand the pressure of their leading rivals moving their entire operations out of state, however, may be as uncertain as whether Briggs and OMC could actually pull it off. The danger of the low-wage strategy and the opportunity of a high-skill strategy are presented in the following section.

3. Low-Wage vs. High Skill Business Strategies

Briggs & Stratton and Harley-Davidson make for a compelling comparison. Each company was founded in Milwaukee in the early part of the century, and prospered here for decades. Each company manufactures similar products with similar technology. Each company has been threatened by the same set of international competitors. In the case of motorcycles, Japanese companies entered the market on the low-end and eroded Harley-Davidson's hold on the premium end of the market. Then, in the case of lawn mower engines, most of these same companies entered the market on the high-end and eroded Briggs' mass market for standard engines. Whereas Harley-Davidson is decisively reestablishing its position on the premium end of its market, Briggs is withdrawing further into the more price-sensitive range of its market. This is

a potentially dangerous move insofar as profit margins are lower on the price-sensitive end, and future technological change and environmental standards may ultimately require a more highly skilled and committed workforce than the low-wage strategy is likely to develop.

Briggs responded to the increasing segmentation of the outdoor power equipment market by opening southern assembly plants on the one hand, and by developing an advanced line of engines on the other. The company entered into an alliance with Daihatsu to manufacture some of the new Vanguard engines in Japan, and some of them at a refurbished facility in the Milwaukee area. Management designed and engineered the new product, invested heavily in new technology, and committed to high performance practices. Management planned to implement job rotation and training within broad classifications, to establish a participatory work environment, and to replace piecework with gainsharing.

As events unfolded, however, the company was unwilling to give up hierarchical authority in exchange for cooperative labor relations. Workers were excluded from product development, sourcing decisions, and process improvement. Management reversed course on job rotation to minimize training investments. The gainsharing plan lowered wages and reduced incentives for

output. Certain suppliers turned out to be problematic, and management failed to reduce cycle time on its own. As a result, Briggs failed to overcome the general skepticism of its bid to attract new customers on the basis of product quality and performance (Knauss, 1994).

When Briggs & Stratton announced an agreement with Mitsubishi to take over its production of the Vanguard line in 1992, the company essentially abandoned its bid to defend the premium end of the market. A successful outcome would have required a much larger investment in developing a skilled and committed workforce, and a much greater willingness to collaborate with the union and suppliers in the reorganization of production. Less than two years later, Briggs & Stratton has announced plans to open three new plants and to lay-off 2,000 more workers. The revised business strategy is explicitly aimed at reducing the labor costs of an aging unionized workforce in the Milwaukee area to restore the price-competitiveness of standard engines.

Management is apparently confident that low-wage workers at greenfield sites are sufficiently skilled to produce and assemble standard engines for the price-sensitive end of the market. If that assumption is correct, then it will be extremely difficult to preserve high-wage jobs in the state. But reducing the price of engines relative to their performance by slashing wage and benefit costs

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is a relatively short-term solution. These one-time savings are likely to come at the expense of the company's long-term capacity to improve products and processes on an incremental basis. If other companies succeed at further segmenting the market, Briggs could become permanently locked into a shrinking portion of the market that allows the lowest profit margins. Furthermore, higher air quality standards are scheduled to take effect at roughly the same time that management plans to start-up new facilities. The company's recent failings in the introduction of higher quality products into the market raise significant doubts about the company's not-too-distant future.

Harley-Davidson faced a similar challenge. Management built a new plant in York, Pennsylvania for chassis fabrication and motorcycle assembly in 1973. The new plant substantially increased production capacity at a time when Japanese manufacturers were making a major push into the U.S. market. Honda and Yamaha, in particular, rapidly eroded Harley's market share with higher quality bikes for a lower price. Severe financial pressures induced a leveraged buy-out by management in 1981.

During the transition period, management refocused on customized and heavyweight touring bikes, and embarked upon a new manufacturing program to improve quality and reduce costs. Harley was one of the first manufacturers

in the area to adopt lean production techniques. By the mid-eighties, the company had implemented just-in-time logistics, statistical quality control, cellular manufacturing, and employee involvement programs. Management estimated that the new system increased productivity by 40%, cut inventory in half, reduced scrap and rework costs by two-thirds, and tripled the delivery of zero defect bikes. Combined with short-term trade protection, the reorganization propelled increasingly strong sales growth.[4] Harley's share of the heavyweight market bounced back from roughly one-quarter to three-quarters within a decade.

Continuous improvement demands closer integration of the design and manufacturing functions, and greater decentralization of responsibility and training to direct production employees and suppliers. Products must be designed to improve manufacturing and assembly processes, while incremental improvements in manufacturing and assembly processes add value to products. The turnaround at Harley-Davidson depended on cooperation between management and labor, and between the company and its suppliers.

Management abandoned early attempts to introduce quality circles outside

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[4] Harley's increasing market share during the mid-1980s was not entirely or even primarily attributable to the short-term tariff hike, because its strongest competitors on the high end of the market had already established domestic plants.

of the bargaining relationship in favor of a joint committee structure within which project teams and work groups operate. Union participation in technology and sourcing decisions, which were previously made unilaterally by management, provides a favorable environment for employee involvement on the workfloor. Some recently formed production cells have been created without supervisors. Although the union membership recently rejected ambiguous contract provisions for team production, the company is clearly headed in the direction of developing a self-directed workforce.

At the same time, Harley-Davidson is collaborating more closely with its outside suppliers. Shortly after the leveraged buy-out, management secured a two percent price reduction from the company's suppliers in exchange for long-term contracts. The company developed a full-time team to provide technical assistance to area suppliers in implementing just-in-time logistics, statistical process control, and employee involvement. Most of Harley's current suppliers are located in close proximity to the local plants.

When the reorganization of production is taken to its limits, hierarchical organizations and arms-length transactions may dissolve into fluid work groups and project teams. The entire production network becomes an ensemble of complementary strategic resources that are augmented through experience and

adapted to change on a continuous basis. In that environment, engineers and technicians need a more intimate understanding of manufacturing and assembly processes, while production workers need a higher level of technical skills. All employees need to share the same core competencies in team-building, process control, and programming. As a rising share of tasks previously reserved for engineers and technicians are pushed down to the workfloor, production workers ultimately acquire the requisite skills for advancing into new occupations. It becomes increasingly possible to revise career ladders such that any motivated worker could acquire new skills and responsibilities throughout her or his worklife.

Although Harley and Briggs have superficially similar training programs, their budgets and contents are quite different. At Briggs, the workplace education center only offers basic skills training. Anecdotal evidence suggests the primary motivation for many workers is the fear of job loss. The company spends half as much per worker as Harley does on additional technical college courses. By contrast, Harley provides much more extensive and advanced training to its workforce. The company has contracted for advanced parts programming courses, and recently purchased two computer-controlled machine simulators to teach the same in-house courses to engineers and production

workers alike.

The comparison of Briggs and Harley is highly instructive. Shifting market forces and technological frontiers do not uniquely determine business strategies. They are strategically chosen in the context of a series of interdependent decisions about market focus, technology choice, work organization, labor relations and workforce training. Although firms can not sustain a premium market focus without qualified suppliers and skilled workers, it does not necessarily follow that management will adopt high performance practices. The low-wage, price-competitive strategy and industrial upgrading may be equally profitable alternatives for the shareholders, but they have a sharply divergent social impact on the state. If public policies are designed to encourage socially preferable business strategies, they should condition public assistance on companies committed to high performance practices, and focus on reducing the cost of transition.

Management effectively has two choices for adjusting to the new manufacturing environment. They can exploit their suppliers and workers to defend their price competitiveness, or cooperate with these stakeholders to improve their quality-competitiveness. These alternative business strategies are more or less incompatible with one another. Industrial upgrading requires a

highly qualified supplier base and a highly skilled workforce, and these stakeholders are unlikely to commit to organizational goals when management is whipsawing them in the name of competitiveness. As a result, the outcome depends on labor market institutions as much as it does on product market signals.

4. Diffusion of High Performance Practices

The workforce development process is potentially thwarted by two fundamental problems of labor market organization. First, management can not adequately represent the interests of all stakeholders when its primary obligation is to the shareholders. Conflicts between management and other stakeholders over performance, compensation and security are almost inevitable. Management must have a sufficiently long time horizon to foresee the profit potential of taking a smaller piece of a larger pie rather than a larger piece of a smaller pie. The low-wage strategy achieves short-term advantages at the expense of the long-term gains of cooperation. But the upgrading strategy imposes costs in the short-term without guaranteeing sufficient pay-offs in the future. Even with a low discount rate on future profits, management must have confidence in both the magnitude of long-term gains and its own share of them to cooperate on a voluntary basis.

Second, management is reluctant to invest in a highly and broadly skilled workforce because other firms may reap much of the rewards. Given the choice of training workers or poaching them, it is perfectly rational for any individual firm to hire workers trained by someone else. But since other firms have the same incentive, each of them limits their training to narrow, firm-specific skills, and externalizes the cost of more general training. Small and medium size firms, which are unable to match the wage rates of large firms in regional labor markets, are especially prone to restricting their investment to informal job training. Even if large firms can attract and train a skilled workforce, this often comes at the expense of parts suppliers and subcontractors in the area. The result is that the sector as a whole is deprived of a highly qualified supplier base and a highly skilled labor pool.

The international experience demonstrates two alternative solutions to these problems. One strategy, best developed in Japan, is to assure workers long-term employment and to assure employers that it will be accepted. With workers kept within particular firms, each individual management is assured payback to training investments. Another strategy, best developed in continental Europe, is to compel (either through public sector and private associative action) a sufficiently large share of firms to train broadly so that each becomes

effectively indifferent to the free mobility of workers between internal and external labor markets. As the European case makes clear, however, the "what's good for the hive is good for the bee" approach requires extra-firm institutional supports.[5]

The United States has the worst of both worlds. Employers are increasingly unable or unwilling to provide lifetime employment, yet in most industries they lack the institutional supports to extend skills standards and wage norms to their competitors. The premise of the U.S. policy discussion is that these supports could be generated on a regional basis through training partnerships and consortia. Several new initiatives focus on a specific industry within the durable goods sector (such as tooling and machining), a single firm's supplier network, or recipients of industrial extension services. The Wisconsin Regional Training Partnership (WRTP) encompasses all types of firms, as well as the Milwaukee metropolitan area's largest and most dynamic manufacturers that drive small firm upgrading through supplier certification requirements.[6]

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[5] The German occupational training system is most advanced. Encompassing employer associations and labor unions negotiate, monitor and enforce increasingly broad occupational standards. Employers are effectively taxed by their associations to support regional training centers for youth apprentices and regional teaching factories for small firms regardless of whether they use these services at any given time.

[6] The WRTP's ambitious design has been recognized by the Council of Great Lakes Governors, the Skills Commission of the Modernization Forum, the Dunlop Commission on the Future of Labor-Management Relations, and academic experts in the field (Wever, Kochan, and

The WRTP combines regional labor market services with an array of industry-specific training consortia, beginning with the durable goods manufacturing sector. Member companies and unions are committed to:

(1) jointly administering workplace education and training programs;

(2) increasing investment in incumbent worker training as a percentage of payroll;

(3) developing future workforce programs for dislocated and disadvantaged workers and youth;

(4) conforming incumbent and future workforce training to skills standards defined on a supra-firm basis;

(5) benchmarking a progression of skills standards to advanced industry practices.

The WRTP currently has 22 charter members, including Harley-Davidson and Waukesha Engine. They are concentrated in metalworking, electronic controls, precision instruments and other related industries in the region. A membership profile is presented in Table 3. Ranging in size from 85 to 4,000 employees, these companies employ nearly 30,000 state residents. Roughly half

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Berg, 1992).

Table 3
WRTP Charter Members

Company	Industry	Employ -ment
AC Rochester	catalytic converters	1200
Allen-Bradley	automation controls, components, systems	4000
Carlson Tool and Mfg.	custom die casting dies & plastic molds	85
Delco Electronics	microcomputers, guidance systems	2400
Electrotek	circuits boards	200
Garden Way	lawn & garden equipment	400
GE Medical Systems	medical equipment	3800
Harley-Davidson	motorcycle engines	1600
Harnischfeger	mining & construction machinery	2468
Johnson Controls - Systems	temperature & other bldg. control devices	3387
Johnson Controls - Battery	automotive & industrial batteries	(above)
MagneTek	drives, drive systems	400
Master Lock	locks, padlocks, lockers	1450
Menasha Color	containers	180
Milwaukee Gear	gears & gear boxes	170
Motor Castings	iron castings	230
Navistar	iron castings	425
PM Plastics	custom plastic parts & products	125
PPG Industry	protective coatings & resins	600
Stroh Die Casting	zinc & aluminum castings	200
Waukesha Engine	engines, generators	900

the membership is comprised of small manufacturers with less than 500 employees. Non-supervisory employees at most (but not all) plants are represented by the Machinists, Steelworkers, Autoworkers or other industrial unions. The WRTP's Executive Council is composed of an equal number of management and labor representatives and a smaller number of public sector representatives, including the state's Labor Secretary and the directors of the area technical colleges and private industry councils.

The WRTP is forging a new consensus between management and labor on the implementation of high performance workplace practices. Promotion and compensation may be tied more closely to demonstrated competencies in exchange for the joint determination of human resource practices. Mutual agreement on qualification requirements and universal access to training protect incumbent workers from arbitrary and capricious decisions. The harmonization of internal labor markets with a sequence of industry-wide skills standards should enable any motivated worker (including incumbent workers, dislocated workers, disadvantaged workers, and youth) to move from any point in the overall skills set to any other point through a series of incremental moves. Management gains a more highly skilled workforce and greater flexibility in its deployment, while workers gain greater security from increased mobility in

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internal and external labor markets.

Business, labor and public sector leaders announced the formation of the Wisconsin Regional Training Partnership in September 1992. The Chairperson of the Governor's Commission on a Quality Workforce, Carl Weigell, and the President of the Wisconsin State AFL-CIO, Jack Reihl, agreed to serve as co-chairs and recruit an interim executive council. The executive council approved a mission statement and organizational charter pledging member companies and unions to the improvement of manufacturing performance and the development of family supporting jobs. Following a successful charter member recruitment drive, a membership meeting was held in May 1993 to organize three working groups on skills standards, incumbent worker training, and future workforce training. These working groups met for six months to build consensus on a series of recommendations that were submitted to the executive council for approval in December.[7]

The executive council unanimously approved the development of a sequence of skills standards benchmarked to advanced industry practices; a future workforce program comprised of employment-linked training for

[7] The incumbent worker training group sponsored focus groups on basic skills training, technical skills training, team-building and related issues with 75 management, labor and education representatives. Each focus group identified best practices, barriers to their implementation, and recommendations for action.

unemployed adults and youth apprenticeship for high school students; a partnership approach to industrial extension services; and a resource center to assist members in skill upgrading and workplace transformation. As a result of the progress that has been made in implementing these recommendations, the WRTP will unveil a comprehensive strategy for supporting the durable goods manufacturing sector at a statewide conference in September (see Table 4).

Skills Standards: The WRTP is the State of Wisconsin's designated representative in the development and implementation of national skills standards. Substantial funding has already been obtained for related curriculum development projects over the next two years. The WRTP is collaborating with area technical colleges to create a progression of manufacturing certificates in basic workplace skills, applied skills such as process control, and technical skills such as parts programming in machining occupations. These certificates will enable non-supervisory employees to accept greater responsibility in their current jobs, get pay raises and job promotions, qualify for apprenticeship opportunities in the skilled trades, and gain advanced standing in a variety of related associate degree programs.

Table 4
Comprehensive Support for High Performance Organizations

<table>
<tr><td colspan="4">WRTP Resource Center</td></tr>
<tr><td colspan="2">Incumbent Worker Training</td><td colspan="2">Future Workforce Training</td></tr>
<tr><td>Workplace Education & Training</td><td>Industrial Extension Service</td><td>Unemployed Adult Model</td><td>School-To-Work Model</td></tr>
<tr><td colspan="4">Curriculum Benchmarking and Certificates</td></tr>
</table>

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Incumbent Worker Training: The WRTP is disseminating a nationally recognized model of workplace education (U.S. Department of Education, 1992). Joint labor-management steering committees design and administer workplace skills centers. They contract with area technical colleges to provide confidential assessment, counseling, training and testing services on-site. Peer advisor networks encourage employee participation in training programs, and increasingly provide tutoring and training to fellow workers. The WRTP is collaborating with area technical colleges to transfer this partnership model to clusters of small firms sharing multi-worksite skills centers in three central city development zones and one suburban industrial park. Workplace and multi-worksite skills centers, customized training programs, and formal peer training form a comprehensive, workplace-based delivery system for incumbent worker training.

Future Workforce Programs: The WRTP is piloting an employment-linked training program for dislocated and disadvantaged workers, and a youth apprenticeship program for high school students. In the adult model, private industry councils fund a thirteen week technical college course in machining or other occupations. Employers guarantee participants high-wage employment if they successfully complete the program. In the youth model, high school

students receive workplace training and related classroom instruction during their junior and senior years. Graduates qualify for production jobs, traditional apprenticeship programs, advanced standing in associate degree programs, and enrollment in four-year colleges and universities.

Industrial Extension: The WRTP is the advisory board of Southeastern Wisconsin's new industrial extension service, the Wisconsin Center on Industrial Competitiveness. The WRTP is identifying suppliers of high performance organizations and other small enterprises to participate in a comprehensive needs assessment process. This presents an opportunity to pilot a partnership approach to manufacturing modernization that is based on cooperation between management and labor, between firms and suppliers, and between industry and government. The incorporation of training commitments into supplier certification agreements should provide a robust mechanism for extending skills standards throughout the durable goods sector.

Resource Center: The WRTP is collaborating with public sector partners to form a resource center. It will provide technical assistance to management and labor in adopting high performance practices, and serve as a clearinghouse for workplace education programs and materials. It will also organize an early detection system to pool expected job openings for future workforce programs,

to assist "at-risk" companies for lay-off aversion, and to improve dislocated worker assistance when job loss is unavoidable.

5. Recommendations

The reorganization of production is fracturing the foundation of the inherited occupational training system. High performance practices erode traditional boundaries between jobs, departments and organizations. Teamwork depends on a widely shared set of core competencies. Engineers and technicians need to know more about the actual production process, while production workers need more technical skills. As more responsibility and training is pushed down to the workfloor, more production workers gain the qualifications for advancement. A sequence of training and certification standards would provide employers with an increasingly skilled and versatile workforce, and enable workers to gain greater mobility in internal and external labor markets.

Recommendation 1: The Wisconsin Technical College System should support curriculum development projects associated with the development of skills standards benchmarked to advanced industry practices. Technical colleges would achieve greater scale economies in program development and delivery. Private Industry Councils would efficiently match an increasingly diverse workforce with the skill needs of heterogenous employers. Firms would be able

to share the cost of upgrading the skills of the workforce, and workers would gain better access to transferable skills.

The WRTP is collaborating with area technical colleges to create a sequence of three manufacturing certificates for production workers. The occupations and competencies associated with each certificate are presented in Table 5. The introductory certificate corresponds to the basic skills that all employees will need to perform entry level jobs, learn new skills, and advance their careers. The intermediate certificate corresponds to the applied skills that all employees need in a high performance workplace, such as process control and team-building. The advanced certificate corresponds to the technical skills that employees need to effectively utilize new technologies, such as parts programming and data editing in machining occupations.

The model for a mature occupational training system in durable goods manufacturing is presented in Table 6. The manufacturing certificates should enable production workers to accept greater responsibilities in their current jobs, gain job promotions and pay raises, qualify for apprenticeship programs, and accumulate credits toward related associate degree programs. The WRTP has designated representatives to serve on the State of Wisconsin's advisory committees on the revision of skills standards for the machine tool, maintenance

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Table 5
Manufacturing Certificates

Certificate	Level	Competencies
Introductory	Traditional Basic Skills	reading, writing, speaking, listening, mathematics...
Intermediate	Applied Occupational Skills	basic job skills, process control, problem-solving, teamwork...
Advanced	Advanced Occupational Skills	parts programming and editing, preventive maintenance, etc...

Table 6
Mature Certification System

Level	Credential	Occupations
1	Introductory Manufacturing Certificate	machine operator, welder & other production jobs
2	Intermediate Manufacturing Certificate	machine operator, welder & other production jobs
3	Advanced Manufacturing Certificate	production machinist, cell technician & other skilled jobs
4	Apprenticeship	tool & die maker, maintenance mechanic & other trades
5	Associate Degree	CAD technician, engineering assistant & other technicians
6	Bachelors Degree	managers & engineers

mechanic and electrician maintenance trades. The area technical colleges are already in the process of establishing a core curriculum for all electronics degree programs, and tentatively express support for doing the same for all metalworking programs. The technical colleges already have articulation agreements with certain institutions that provide graduates in some programs with advanced standing in four-year programs. In the not-too-distant future, any motivated individual -- incumbent workers, dislocated workers, disadvantaged workers, and youth -- should be able move through a seamless education and training system throughout their careers.

Recommendation 2: The Wisconsin Technical College System should utilize industrial extension services to extend the coverage of skills standards and wage norms from industry leaders to the rest of the sector. A partnership approach would create new family-supporting jobs, rather than shift jobs from high-wage firms to low-wage firms. It would take advantage of the potential willingness of employees in customer firms to provide technical assistance to their suppliers, and employees in recipient firms to identify and solve problems on their own. It would exert uniform pressure for workplace change and permit greater scale economies in program delivery to maximize the impact of public resources on economic performance. In short, it would leverage more resources,

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require less consulting time, lead to more change, and create better jobs than the traditional approach.

The WRTP is collaborating with the Wisconsin Center on Industrial Competitiveness in Southeastern Wisconsin (WISCIC/SE) to pilot the partnership approach to small firm upgrading. In this model, management and labor in leading firms reach a cooperative agreement to assist their suppliers in exchange security provisions. These core firms reach a cooperative agreement with their preferred suppliers to adopt high performance practices in exchange for technical assistance. The industry reaches a cooperative agreement with the public sector to devote industrial extension and workforce development services to small firms adhering to industry skills standards. Labor-management agreements, supplier certification requirements, and targeted public assistance should reinforce one another for the benefit of all stakeholders.

The Wisconsin Technical College System recently agreed to fund the pilot project and related curriculum development effort, and anticipates a federal planning grant to develop a statewide industrial extension service. Consideration should be given to five criteria: (a) the quality of business and labor participation on the WISCIC board of directors in each region of the state; (b) the provisions for collaborating with management and labor in lead firms to

upgrade supplier networks; (c) the provisions for employee participation in recipient firms, including unionized and unrepresented firms; (d) the quality of staff available to assist lead firms in reaching labor-management agreements on supplier upgrading; and (e) the quality of staff available to work with joint committees in recipient firms.

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